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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/650,610	08/27/2003	Kentaro Nagoshi	TOW-038	8319

959 7590 10/27/2004

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EXAMINER	
AUSTIN, MELISSA J	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 10/27/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/650,610	NAGOSHI ET AL.
	Examiner	Art Unit
	Melissa Austin	1745

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☒ Claim(s) *10, 14 and 15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

2. The drawings received August 27, 2003 are acceptable for examination purposes.

Information Disclosure Statement

3. The Information Disclosure Statement (IDS) filed on August 27, 2003 has been considered by the examiner.

Specification

4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

5. The disclosure is objected to because of the following informalities:

Pg. 1, ln 5: Insert "a" between "to" and "fuel."

Pg. 2, ln 12: The Japanese patent publication number is a Japanese patent number. The publication number is 06-005289.

Pg. 7, ln 26: "predetermined"

This list is not exhaustive.

Appropriate correction is required.

Claim Objections

6. Claim 10 is objected to because of the following informalities: line 3 of claim 10 should read, "predetermined distance." Appropriate correction is required.

7. Claims 14 and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Reiser (US 2002/0068214), as evidenced by the current application. Reiser teaches a fuel cell that includes a membrane electrode assembly (MEA) secured between plates (Fig. 1: 12, 14; applicant's separators). The MEA is made of an electrolyte (Fig. 2: 46; applicant's electrolyte membrane) between anode and cathode catalysts (Fig. 2: 48, 50; applicant's electrode catalyst layer). A porous gas diffusion layer (Fig. 2: 58, 54; applicant's diffusion member) is secured between water transport plates and the catalyst layer for both electrodes. An electrolyte dry-out barrier is formed by impregnating the gas diffusion layers of the electrodes with a dry-out barrier material, such as resin. (Pg. 2, [0021]; Pg. 3, [0023]; Pg. 4, [0033], [0034]). Foamed metal is a common material for use in a diffusion layer in prior art, as evidenced by the current application (Pg. 3, ln 26-27).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1, 2, and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214).

With respect to claim 1, Fly teaches a fuel cell with a membrane electrode assembly (MEA) including anode and cathode catalyst layers sandwiching a solid polymer electrolyte membrane (Figure 4: 68, 70, and 64; Pg. 3, [0044]). A bipolar plate assembly includes a metallic foam media (applicant's foamed member made of metal) gas distribution layer (applicant's diffusion member) and a separator plate and is disposed on either side of the MEA with the gas distribution layers adjacent the MEA (Pg. 1, [0004], [0008]; Pg. 3, [0045]). The gas distribution layer is a sheet of porous media with regions of varying porosity. However, Fly fails to teach a resinous member in the metallic foam gas distribution layer.

Reiser teaches a fuel cell with a porous gas diffusion layer (applicant's diffusion member) that is impregnated with resin (Pg. 4, [0033], [0034]) for the purpose of forming an electrolyte dry-out barrier. The dry-out barrier allows for the fuel cell to receive very dry reducing fluid and oxidant streams without drying out the electrolyte (Pg. 5, [0039]). Impregnate means "to fill throughout; saturate[1];" thus, one of ordinary skill in the art would realize that impregnating a porous substrate, the metallic foam, fills the pores and creates a region of lower porosity than that of the bulk material.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have impregnated with resin, as taught by Reiser, the metallic foam gas distribution layer of the fuel cell taught by Fly et al. for the purpose of forming an electrolyte dry-out barrier allowing for delivery of very dry reducing fluid and oxidant streams to the fuel cell without drying out the electrolyte.

Regarding claim 2, the limitations of claim 1 discussed immediately above are incorporated herein. Fly also teaches that the gas distribution layer includes alternating strips of high porosity material and low porosity material (Figure 7: 46.4, 46.6). The low porosity strips form barriers (applicant's flow field walls) to channel the flow of reactant gases across the face of the MEA (Pg. 4, [0055]; applicant's reactant gas flow through flow field along electrode). Fly does not teach that the lower porosity material is

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[1] *The American Heritage® Dictionary of the English Language, Third Edition* copyright © 1992 by Houghton Mifflin Company. Electronic version licensed from INSO Corporation; further reproduction

a resinous member in the metallic foam; however, Reiser teaches the impregnation of resin in a gas diffusion layer (see above 35 USC 103 rejection of claim 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to alternate strips of high and low porosity in the gas distribution layer to create reactant gas flow fields directing reactant gas along the electrode as taught by Fly et al. with the areas of low porosity in the gas distribution layer being formed by impregnating resin into the porous layer as taught by Reiser in order to deliver very dry reducing fluid and oxidant to the electrode without drying out the electrolyte.

Regarding claim 4, the limitations of claim 2 discussed immediately above are incorporated herein. Fly does not teach the method by which the areas of lower porosity are created in the metallic foam gas distribution layer; however, Reiser teaches impregnation of the porous gas diffusion layer with resin (see above 35 USC 103 rejection of claim 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed the flow field walls in the gas distribution layer as taught by Fly et al. by impregnating with resin the porous gas diffusion layer as taught by Reiser in order to deliver very dry reducing fluid and oxidant to the electrode without drying out the electrolyte.

12. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214) as applied to claims 1 and 2 above, and further in view of Watkins et al. (5,108,849). The limitations of claims 1 and 2 discussed immediately above are incorporated herein. Neither Fly nor Reiser disclose flow field walls extending from opposite ends of an electrode alternately forming a serpentine passage.

However, Watkins teaches a single continuous fluid flow channel (applicant's reactant gas flow field) in a serpentine pattern. As seen in Figure 2, the flow field walls alternately extend from opposite ends of the electrode. This configuration traverses the electrode in a plurality of closely spaced passes assuring access to the reactant gases to substantially the entire electrode surface. The continuous

channel also ensures that water formed is pushed through the channel by the gas flow and exhausted from the cell so that no dead spots form due to blockages. (Col. 5, ln 52-57, 66- Col 6, ln 3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have employed serpentine channels as taught by Watkins in the fuel cell as taught by Fly and Reiser in order to prevent water blockages and effectively cover the electrode surface with reactant gas.

13. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214) as applied to claims 1 and 2 above, and further in view of Rock (6,099,984). The limitations of claims 1 and 2 discussed immediately above are incorporated herein. Neither Fly nor Reiser disclose flow field walls extending from opposite ends of an electrode alternately forming a serpentine passage.

However, Rock teaches that serpentine flow channels (applicant's reactant gas flow field) are known and provide the advantage that they permit gas flow between adjacent legs of the same channel even then the flow channel is blocked (Col. 2, ln 3-22). Rock also teaches a serpentine pattern in which the legs extend from opposite ends of the electrode; that is the inlet legs extend from one end and the outlet legs extend from the other end (Col. 5, ln 19-29; Figure 5). This configuration places inlet legs adjacent other inlet legs and outlet legs adjacent other outlet legs; therefore, no pressure drop is developed between inlet legs resulting in no leakage under normal operating conditions from one leg to another (Col. 5, ln 46-51).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have employed serpentine channels as taught by Rock in the fuel cell as taught by Fly and Reiser in order to prevent blockages and reduce the occurrence of leakage from one leg to another under normal operating conditions.

14. Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214) as applied to claim 1 above, and further in view of

Kuroki et al. (WO 2002/089240, using US 2004/0137303 as translation). The limitations of claim 1 discussed immediately above are incorporated herein.

Regarding claims 5 and 6, neither Fly nor Reiser disclose resinous flow field walls forming a reactant gas passage for flowing reactant gas in the stacking direction of the fuel cell.

However, Kuroki teaches a gas diffusion layer (applicant's diffusion member) with a gasket material impregnation portion (Figure 15: 5, 10). The impregnation material can be resin (Pg. 5, [0068]). As seen in Figure 19, a section of the impregnated gas diffusion layer can be cut out to provide a manifold (Pg. 9, [0122]; applicant's reactant gas passage) with resinous walls. A stack is assembled by placing separators on either side of the unit electrode assembly (UEA); as such, this manifold allows for flow of the reactant gasses in the stacking direction of the cell. This structure provides for easier stacking of the separator and UEA, automation of the process, and reduction in the cost for manufacturing the stack.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included in the fuel cell as taught by Fly and Reiser the manifold for reactant gas passage in the stacking direction of the fuel cell with resinous walls formed by impregnation as taught by Kuroki in order to provide for easier stacking of the separator and UEA, automation of the process, and reduction in the cost for manufacturing the stack.

Regarding claims 7 and 8, neither Fly nor Reiser disclose a resinous seal forming a reactant gas passage for flowing reactant gas in the stacking direction of the fuel cell.

However, Kuroki teaches a gas diffusion layer (applicant's diffusion member) with a gasket material impregnation portion (Figure 15: 5, 10). The impregnation material can be resin (Pg. 5, [0068]). As can be seen in Figure 19, an insulating spacer (12, 13) can be formed by impregnating the gas diffusion layer (5, 6) with resin (Pg. 5, [0074]). Although the reference does not disclose this structure as a seal, one of ordinary skill in the art would recognize that it acts as a seal between the unit electrode assembly (UEA; 2,3,4) and manifold. As is well known in the art, without seals, reactant gasses could mix or escape from the cell structure.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have included the insulating spacers as taught by Kuroki in the fuel cell as taught by Fly and Reiser in order to prevent reactant gasses from mixing or escaping the cell structure.

15. Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fly et al. (US 2002/0114990) in view of Reiser (US 2002/0068214). The limitations of claim 1 discussed above are incorporated herein.

The references do not specifically disclose resinous supports in the diffusion member.

Regarding claim 9 and 13, however, the areas of lower porosity as taught by Fly formed by impregnation of resin into the gas diffusion layer as taught by Reiser would inherently possess the ability to support a load applied to the fuel cell in the stacking direction absent any clear evidence to the contrary. Applicant has imposed no definite structure to the supports.

Regarding claim 10, the limitations of claim 9 as discussed immediately above are incorporated herein. Fly's areas of low porosity (Figure 6: 46.6) extend to the surface of the gas distribution layer. One of ordinary skill in the art would recognize that when assembled next to the electrode catalyst layer, these low porosity areas are spaced a predetermined distance from the catalyst layer.

Regarding claims 11 and 12, one of ordinary skill in the art would recognize that when stacked the resinous supports would provide the greatest support of a load in the stacking direction if they are aligned in the stacking direction, thus creating a continuous reinforcement.

Allowable Subject Matter

16. Claims 14 and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

17. The following is a statement of reasons for the indication of allowable subject matter: the prior art does not state: 1) a metal stopper interposed between resinous supports or 2) resinous supports are planar plates embedded in foamed member.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melissa Austin whose telephone number is (571) 272-1247. The examiner can normally be reached on Monday - Friday, 7:15 AM - 3:45 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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